

FACULTY OF SCIENCE  
M.Sc. I – Semester (CBCS) Examination, December 2016

Subject: Chemistry

Paper – I  
Inorganic Chemistry

Time: 3 Hours

Max.Marks: 80

**Note: Answer all questions from Part-A and Part-B.****Each question carries 8 marks in Part-A and 12 marks in Part-B.**

**PART – A (4x8 = 32 Marks)**  
**[Short Answer Type]**

- 1 a) Define rotational axis of symmetry. Explain types of rotational axes with suitable examples.  
b) Discuss descent in symmetry by substitution with suitable examples.
- 2 a) What are the salient features of CFT? Draw the crystal field splitting diagram of the 'd' orbitals in trigonal bipyramidal geometry.  
b) What is CFSE? Calculate the CFSE for  
i)  $[\text{CoCl}_4]^{2-}$   
ii)  $[\text{Fe}(\text{CN})_6]^{3-}$   
iii)  $[\text{Cr}(\text{H}_2\text{O})_6]^{2+}$
- 3 a) What is a ternary complex? Discuss the formation of ternary complex with suitable example.  
b) Discuss the effect of metal ion on stability constants of metal complex.
- 4 a) Give a brief account on 18-electron rule.  
b) Explain the bonding modes of NO in metal-nitrosyl complexes.

**PART – B (4x12 = 48 Marks)**  
**[Essay Answer Type]**

- 5 a) What is molecular point group? Identify the symmetry elements in the following molecules and assign the point group.  
i)  $\text{SOCl}_2$   
ii)  $\text{NH}_3$   
iii)  $\text{BF}_3$   
b) Deduce the number of symmetry operations from  $S_6$  and  $S_7$  axes.

OR

- c) Work out symmetry elements in  $O_h$  point group with suitable example.  
d) Write a note on symmetry criteria for optical activity.
- 6 a) What is Jahn-Teller theorem? Explain it with suitable example.  
b) How do you calculate magnetic moment values from magnetic susceptibility? Write the applications of magnetic moment for the determination of stereochemistry.

OR

- c) Explain spin crossover phenomenon with suitable examples.  
d) Discuss the quenching of orbital angular momentum in metal complexes.
- 7 a) Discuss the principle involved in the pH metric method of determining stability constant of a complex.  
b) Write a short note on:  
i) Chelate effect  
ii) Cryptate effect
- OR
- c) Explain Pearson theory of HSAB. Give examples.  
d) Describe the polarographic method for the determination of stability constant of a metal complex.
- 8 a) Draw the molecular orbital energy level diagram of CO and explain its donor and acceptor properties.  
b) Write an account on chemical fixation of dinitrogen.

OR

- c) Explain the structural aspects of  $[\text{RuCl}(\text{PPh}_3)_2(\text{NO})_2]^+$  and  $[\text{IrCl}(\text{PPh}_3)_2(\text{CO})(\text{NO})]^+$ .  
d) Discuss all possible evidences in favour of multiple bonding in metal carbonyls.

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